Nationwide Health Information Network (NHIN)

Patient Discovery
Web Service Interface Specification

V 1.0

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Document Change History

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0.3		Karen Witting	Initial Draft
0.4	8/27/09	Karen Witting	Update
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1 Preface

1.1 Introduction
The Nationwide Health Information Network (NHIN) Web Service Interface specifications define the core set of standard services to be implemented by each node on the NHIN network in order exchange interoperable health information over the Internet. Health Information Organizations (HIOs) which act as nodes on the NHIN are termed NHIOs. These functional services provide discovery and information exchange capabilities and rest upon a foundational set of messaging, security, and privacy services.

This document presents the NHIN Patient Discovery Web Service Interface specification. The purpose of this service is to allow one node on the NHIN query another in order to reciprocally establish patient identity and to determine if a node is a potential source of available information for a specific patient.

1.2 Intended Audience
The primary audiences for NHIN Specifications are the individuals responsible for implementing software solutions that realize these interfaces at Health Information Organizations (HIOs) who are, or seek to be, nodes on the NHIN network. This specification document is intended to provide an understanding of the context in which the web service interface is meant to be used, the behavior of the interface, the Web Services Description Language (WSDLs) used to define the service, and any Extensible Markup Language (XML) schemas used to define the content.

1.3 Business Needs Supported by this Specification
The NHIN Patient Discovery Service is intended to provide a mechanism for NHIOs to address difficulties in efficiently and reliably establishing the identity of mutual patients prior to exchanging patients' health information. This specification is intended to address the following challenges:

   a) Lack of National Patient ID

   b) Inconsistent patient demographic attributes among HIOs and their data sources

   c) Disparate and disconnected Master Person Indexes (MPIs) and independent matching algorithms

   d) Consumer privacy restrictions

Patient matching is conducted by probabilistic matching, which by its nature, entails a degree of risk for false positive and false negative matches. These risks and corresponding mitigations are detailed in Appendix B "Risks and Mitigation."

1.4 Referenced Documents and Standards
The following documents and standards were referenced during the development of this specification. Specific deviations from or constraints upon these standards are identified below.

   1) **Org/SDO name:** IHE

   Reference # / Spec Name: IT Infrastructure Cross-Community Patient Discovery (XCPD) ITI-55

   Version #: 2009-8-10

   NHIN Deviations or Constraints:

   - IHE XCPD - Only two patient discovery transaction modes are supported by this specification (for more details, see section 3.1.1)

   - IHE XCPD Section 3.55.4.2.3 – Use Case #2 is not supported by this specification (for more details, see section 3.1.1)

   - IHE XCPD – CorrelationTimeToLive SOAP header and revoke message will not be used by this specification (for more details, see section 3.1.3)

- IHE XCPD – A set of demographic attributes is required in the request and response by this specification (for more details, see section 3.1.4)

Underlying Specs:

Link:
http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_Supplement_XCPD_PC_2009-08-10.pdf

2) **Org/SDO name:** IHE

Reference # / Spec Name: ITI TF Vol. 1 & 2a, 2b, 2x, 3

Version #: Revision 6.0 (2009-8-10)

NHIN Deviations or Constraints:

Underlying Specs:

Links:

- http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol1_FT_2009-08-10-2.pdf
- http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol2a_FT_2009-08-10-2.pdf
- http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol2b_FT_2009-08-10.pdf
- http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol2x_FT_2009-08-10.pdf
- http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol3_FT_2009-08-10-2.pdf

3) **Org/SDO name:** HL7

Reference # / Spec Name: Patient Administration DSTU, Patient Topic

Version #: v. 3 Edition 2008

NHIN Deviations or Constraints:

Underlying Specs:

Link:

At publishing, HL7 standards are proprietary and available only to HL7 membership. A link cannot be provided.

4) **Org/SDO name:** Internet Engineering Task Force's (IETF)

Reference # / Spec Name: RFC3966 "The tel URI for Telephone Numbers"

Version #: December 2004

NHIN Deviations or Constraints:

Underlying Specs:

Link:

http://www.ietf.org/rfc/rfc3966.txt

1.5   Relationship to other NHIN Specifications

This specification is related to other NHIN specifications as described below:

- **Messaging Platform –** specifies a base set of messaging standards and web service protocols which must be implemented by each NHIN node and applies to all transactions. All NHIN inter-

nodal messages are SOAP messages over HTTP using web services, must be encrypted and digitally signed.

- **Authorization Framework** – defines the exchange of metadata used to characterize each NHIN request. The purpose of that exchange is to provide the responder with the information needed to make an authorization decision for the requested function. Each initiating message must convey information regarding end user attributes and authentication using SAML 2.0 assertions.

Together, the Messaging Platform and the Authorization Framework define the foundational messaging, security and privacy mechanisms for the NHIN.

- **Query for Documents** – allows an initiating node to request a patient-specific list of available documents from a responding node using the Patient ID obtained via a prior Patient Discovery transaction. It represents the second of three steps in the typical NHIN Query/Retrieve information exchange pattern.

- **Retrieve Documents** – allows an initiating NHIN node to retrieve specific documents from a responding node using the Document Reference IDs obtained via a prior Query for Documents transaction. It represents the final of the three steps in the typical NHIN Query/Retrieve information exchange pattern.

- **Web Services Registry** – enables nodes to discover each other through interactions with the NHIN UDDI registry, which lists NHIN nodes, the NHIN web services supported by each node, and how to reach those service end points. In this context, it might be needed to identify target nodes.

2 Interface Description

2.1 Definition

A request and response transaction which allows one NHIN node to query others in order to identify nodes which may serve as potential sources of health information for specific patients.

Note that in this specification, the term "patient" is used to refer to the person about whom health-care related information is being sought or provided. It is not necessarily implied that the patient is actively receiving medical care.

The context for using this interface is described using IHE IT Infrastructure Technical Framework – Cross-Community Patient Discovery (XCPD) Supplement Draft for Trial Implementation, August 10, 2009
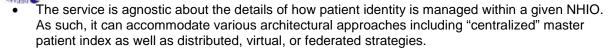
The role of the initiating NHIO that of a XCPD Initiating Gateway

The role of the responding NHIO is that of a XCPD Responding Gateway.

2.2 Design Principles and Assumptions
The following assumptions or design principles underlie this specification:

- The initiating NHIO has identified other NHIOs likely to hold a specific patient's information. Patient Discovery requests are not intended to be broadcast across the NHIN.

- The initiating NHIO provides patient-specific demographic data for use by the responding NHIO to evaluate whether the patient is known to the responding NHIO.

- If the responding NHIO makes a match, it provides the set of demographics locally associated with of the matched person to the initiating NHIO who can either trust the candidate match, or use the returned patient demographics to evaluate the candidate match.

- The specification allows NHIOs to independently make identity correlations based on their own algorithm and not that of another NHIO.

- The service is agnostic about the details of how patient identity is managed within a given NHIO. As such, it can accommodate various architectural approaches including "centralized" master patient index as well as distributed, virtual, or federated strategies.

- The specification makes no assumption about the longevity of any patient identifier exchanged through these transactions. If a patient identifier becomes invalid, subsequent use of it in a Query for Documents will result in an error.

- The specification assumes that patient identifiers, once shared with another NHIO, are NEVER reassigned to another person.

- How an NHIO determines which other NHIOs to direct queries is not specified. This is a local NHIO decision.

- An NHIN Gateway directs a query to other individual NHIOs. This specification does not define a central or federated service that performs transactions across multiple NHIOs.

- Patient matching is conducted by probabilistic matching, which by its nature, entails a degree of risk for false positive and false negative matches. These risks and corresponding mitigations are detailed in Appendix B "Risks and Mitigation."

2.3 Triggers

An edge system seeking sources of health information for a specific patient which may be held by other NHIOs submits a patient discovery query to its NHIO's Gateway (the format of that query is outside the scope of this specification). In turn, the NHIN Gateway sends a query to the HIO(s) likely to hold information for that specific patient (the means by which an NHIO determines which other HIOs are likely sources is outside the scope of this specification). The query includes a minimum set of patient demographics.

2.4 Transaction Standard

NHIN Patient Discovery utilizes IHE ITI-55: Cross Gateway Patient Discovery (XCPD) transaction. XCPD has not yet been evaluated by HITSP. XCPD has been constrained within this NHIN specification to exclude one of the described transaction modes. Further, NHIN restricts XCPD to returning a single entry per assigning authority, as described in Section 3.1.6 "Returning Multiple Entries".

The location of these documents, as well as other foundational standards for this transaction, is listed in Section 1.4 "Referenced Documents and Standards".

2.5 Technical Pre-conditions

The following technical pre-conditions exist for this interface specification:

- NHIOs likely to serve as sources of a specific patients' health information have been identified.

- Target NHIOs' relevant service endpoints have been obtained from the NHIN Service Registry.

- The patient has provided their consent to share their information

2.6 Technical Post-conditions
The following technical post-conditions will result after the execution of this interface specification:

- Errors encountered will be handled, as specified in Section 4 "Error Handling".

- Audit records are created and stored by both the requesting and responding NHIO, as described in section 5 "Auditing".

- A correlation, or lack thereof, is made between patients registered at the initiating and each of the responding NHIOs.

- Consumer preferences and local policies and permissions were enforced by the responding NHIO. Only those patients who have provided consent are discoverable.

3   Interface Definition

3.1   ITI-55 – Cross Community Patient Discovery

This specification adopts the XCPD Cross Gateway Patient Discovery transaction [ITI-55] as the protocol for patient discovery. ITI TF-2b: 3.55 (within the XCPD Supplement) provides a detailed description of this transaction. Sample messages are provided in Appendix A.

All details of the transaction as described in IHE ITI TF-2b: 3.55 (within the XCPD Supplement) are adopted, except as modified and clarified in this section. The following subjects are discussed:
- Synchronous and Asynchronous transport
- Use of CorrelationTimeToLive and Revoke
- Patient Discovery Transaction Modes
- Specifying community patient identifier in the request
- Demographic requirements on request and response
- Returning multiple entries
- Use of Health Data Locator

3.1.1   Synchronous and Asynchronous Transport

The IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] supports both synchronous and asynchronous operations of the transaction. Initiating Gateways are required to implement one or both of synchronous and asynchronous and are encouraged to use asynchronous whenever feasible to allow responding gateways to manage local resources most effectively. Responding Gateways are required to support both, but have the option of rejecting synchronous requests when system resources are taxed.

3.1.2   Use of Revoke and CorrelationTimeToLive

The NHIN will not make use of the Revoke message described in the IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55].

The NHIN will not make use of the CorrelationTimeToLive SOAP header described in the IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55].

3.1.3   Patient Discovery Transaction Modes

The IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] describes three modes of use. These modes and their expected use in the NHIN are listed below:
1. Demographic Query and Feed - Both the demographics and patient identifier used by the initiating NHIO are included in the request. This will be the primary mode used on the NHIN.
2. Demographic Query only mode – Only the demographics of the patient are included in the request. The initiating NHIO does not have, or does not specify a patient identifier. This mode is used *only* when an NHIO is a consumer but not a supplier of health data[1].

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[1] An example user of this mode is the Social Security Administration. SSA consumes health data from other NHIOs, but does not supply it.

3. Shared/national Patient Identifier Query and Feed – Only a shared/national identifier is specified in the request. *Use of this mode will be deferred until a clear use case is presented.*

This specification adopts all cases described in Section 3.55.4.2.3 of the XCPD supplement except for Case #2 which is not supported. This specification restricts to returning a single entry per assigning authority, as described in Section 3.1.6 "Returning Multiple Entries" which is a specialization of Case #1.

3.1.4   Specifying Patient Identifier in the Request

When using the Demographic Query and Feed mode, Initiating NHIOs must provide the "primary" patient identifier within the Patient Discovery request. This "primary" patient identifier is used by the responding NHIO in an independent query transaction to request information about the patient from the Initiating NHIO. In this independent query the roles of initiator/responder are reversed (reverse query). This identifier is specified as a value element within one of the LivingSubjectID elements and consists of the assigning authority ID and the Patient ID. To identify WHICH LivingSubjectID element contains the "primary" patient identifier the assigning authority ID corresponds with the assigning authority ID specified as the id element within the assignedDevice associated with the authorOrPerformer element.

The syntax of the Patient Identifier is included in the example below. Note that other items to be included in the parameterList are not displayed in this example for brevity.

```
<controlActProcess classCode="CACT" moodCode="EVN">
        <code code="PRPA_TE201305UV02" codeSystem="2.16.840.1.113883.1.6"/>
        <!-- Identifies the first LivingSubjectID in the parameterList as the patient
        Identifier -->
        <authorOrPerformer typeCode="AUT">
                <assignedDevice>
                        <id root="1.2.840.114350.1.13.99997.2.3412"/>
                </assignedDevice>
        </authorOrPerformer>

        <queryByParameter>
                <queryId root="1.2.840.114350.1.13.28.1.18.5.999" extension="18204"/>
                <statusCode code="new"/>
                <parameterList>
                        <LivingSubjectId>
                        <value root="1.2.840.114350.1.13.99997.2.3412" extension="1234"/>
                        <semanticsText>LivingSubject.id</semanticsText>
                </parameterList>
        </queryByParameter>
</controlActProcess>
```

See ITI-55 section 3.55.4.1.2.4 for further details on specifying values used by responder The section **Community patient id assigning authority** addresses the above in more detail.

3.1.5   Demographic Requirements in Request and Response

Gateways should specify an appropriate collection of demographics that balance the needs of:
- Reliable demographic matching to ensure a minimum of false negative and false positive matches
- Avoidance of privacy issues in case of a security break especially to avoid potential for identity fraud as a result of a security break

Required values for the Patient Discovery request:
1. LivingSubjectName Parameter: Both "family" and "given" elements are required. If patients are known by multiple names or have had a name change, the alternative names shall be specified as multiple instances of LivingSubjectName. Inclusion of all current and former names increases the likelihood of a correct match but may incur privacy concerns. The sequence of given names in the given name list reflects the sequence in which they are known – first, second, third etc. The

first name is specified in the first "given" element in the list. Any middle name is specified in the second "given" element in the list when there are no more than two "given" elements.

2. LivingSubjectAdministrativeGender Parameter: Is required. Coded using the HL7 coding for AdministrativeGender; namely code equal to one of "M" (Male) or "F "(Female) or "UN" (Undifferentiated).

3. LivingSubjectBirthTime Parameter: Is required. The contents must contain the greatest degree of detail as is available.

Required values for the Patient Discovery response:

1. Person.name element: Both "family" and "given" elements are required. If patients are known by multiple names or have had a name change, the alternative names shall be specified as multiple Patient.name elements. Inclusion of all current and former names increases the likelihood of a correct match. The sequence of given names in the given name list reflects the sequence in which they are known – first, second, third etc. The first name is specified in the first "given" element in the list. Any middle name is specified in the second "given" element in the list when there are no more than two "given" elements.

2. Person.AdministrativeGenderCode element: Is required. Coded using the HL7 coding for AdministrativeGender; namely code equal to one of "M" (Male) or "F "(Female) or "UN" (Undifferentiated).

3. Person.BirthTime Parameter: Is required. The contents must contain the greatest degree of detail as is available.

Required values *if available and if allowed* for the Patient Discovery Request and Response:
 (in both the request and response).

1. Address – The "streetAddressLine", "city", "state", "postalCode" shall be used for elements of the address. Multiple "streetAddressLine" elements may be used if necessary and are specified in order of appearance in the address. For more information about coding of addresses see http://www.hl7.org/v3ballot/html/infrastructure/datatypes/datatypes.htm#prop-AD.formatted

2. PatientTelecom – a single phone number. See section 3.1.4.1 for details regarding coding of phone numbers.

3. Social Security Number – SSN is specified in a LivingSubjectId element – potentially one of several. When specified within the response, the SSN is specified in an OtherIDs element. SSN is designated using the OID 2.16.840.1.113883.4.1.

Others values as listed in the IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] are allowed but not listed here.

3.1.5.1 Coding Telephone Numbers

Telephone number support MUST be implemented in a "tel" URI as specified in the Internet Engineering Task Force's (IETF) RFC3966 and as further defined in the International Telecommunications Union's E.123. The location of IETF RFC3966, as well as other foundational standards for this transaction, is listed in Section 1.4 "Referenced Documents and Standards".

The URI syntax MUST be as specified in RFC3966 Section 3. The "tel" URI has the following syntax for the commonly used US and non-US telephone numbers:

    telephone-uri = "tel:" telephone-subscriber
    telephone-subscriber = global-number -or- local-number

Examples, provided as an aid to implementers, are specified in RFC3966 and are reproduced below.

tel:+1-201-555-0123: This URI points to a phone number in the United States.

A non-US example, modified from E.123 Section 2.3 is: tel:+22-607-123-4567

3.1.6   Returning Multiple Entries

The response to IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] may contain multiple entries, but only a single entry per assigning authority is allowed. This is a restriction above the base standard specification. Each entry returned reflects a different source of data within the responding community. In order to access all data for that patient in the community the initiator would need to use all identifiers returned. This is a refinement of the base specification with applies this logic at the homeCommunityId level rather than at the assigning authority level.

The choice of allowing one or zero entries per assigning authority is a compromise between false negatives and false positives. Allowing multiple matches per assigning authority would increase the risk of false positives. Requiring only a single entry per assigning authority may force a responding community to return zero matches because no single choice is appropriate, thus increasing the likelihood of false negatives. It is recommended that if the responding gateway has more than one close match it should return the special error condition, described in Section 4 "Error Handling", which will suggest that the requesting community may want to address the matching issue through manual means.

The assigning authority is specified as the root attribute of the Patient id element. As constrained by XCPD Table 3.55.4.2.2-1 there will be exactly one Patient id element per Registration Event. As stated above, this specification constrains this further to require each Registration Event element to have a unique value in the Patient id root attribute element.

Below is a fragment of the response showing the coding of assigning authority 1.2.840.114350.1.13.99998.8734:

```
<registrationEvent classCode="REG" moodCode="EVN">
    <id nullFlavor="NA"/>
    <statusCode code="active"/>
    <subject1 typeCode="SBJ">
        <patient classCode="PAT">
            <id root="1.2.840.114350.1.13.99998.8734" extension="34827K410"/>
```

3.1.7   Support for Health Data Locator

This transaction will not support designation as a health data locator. All responses will indicate "NoHealthDataLocator" as described in HE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] section 3.55.4.2.2.5.

The coding of this designation is:
```
<subject typeCode="SUBJ">
    <registrationEvent classCode="REG" moodCode="EVN">
        <id nullFlavor="NA"/>
        <statusCode code="active"/>
        <subject1 typeCode="SBJ">
            … (details of the matching patient)
        </subject1>
        <custodian typeCode="CST">
            <assignedEntity classCode="ASSIGNED">
                <id root="1.2.840.114350.1.13.99998.8734"/>
                <code code="NoHealthDataLocator"
                    codeSystem="1.3.6.1.4.1.19376.1.2.27.2"/>
            </assignedEntity>
        </custodian>
    </registrationEvent>
</subject>
```

4   Error Handling

This specification adopts all the errors conditions specified in IHE XCPD Cross Gateway Patient Discovery Transaction [ITI-55] sections 3.55.4.2.2.6 and 3.55.4.2.2.7. The list of conditions is replicated here. The coding of these conditions is described in the base standard.

4.1   Special Handling for More Attributes Requested

If a responding gateway determines that additional attributes may help to achieve a match, it may respond with a specialized set of error codes. The following table documents the coded values to designate additional demographic attributes that may help achieve a match.

Table 3.55.4.4.2-4 Coded values for codeSystem=1.3.6.1.4.1.19376.1.2.27.1

Value for code	Meaning of code
LivingSubjectAdministrativeGenderRequested	Requests the LivingSubjectAdministrativeGender attribute be specified
PatientAdressRequested	Requests the PatientAddress attribute be specified
PatientTelecomRequested	Requests the PatientTelecom attribute be specified
LivingSubjectBirthPlaceNameRequested	Requests the LivingSubjectBirthPlaceName attribute be specified
LivingSubjectBirthPlaceAddressRequested	Requests the LivingSubjectBirthPlaceAddress attribute be specified
MothersMaidenNameRequested	Requests the MothersMaidenName attribute be specified

In addition to these coded values, Table 3.55.4.4.2-4 is extended in this NHIN specification to include[2]:

Value for code	Meaning of code
SSNRequested	Requests the a Social Security Number be specified

4.2   Specify Details about Problems Handling Request

The following table documents the coded values to designate special conditions that may come up when attempting to respond to a request.

Table 3.55.4.4.2-5 Coded values for codeSystem=1.3.6.1.4.1.19376.1.2.27.3

Value for code	Meaning of code
ResponderBusy	The responder was not able to process the request because it is currently overloaded.
AnswerNotAvailable	The answer is not available. Human intervention may be needed.

5   Auditing

The transaction shall be audited by NHIO Gateways as described in Section 3.55.5.1 in the XCPD Supplement.
This section of the supplement is copied below for reference only. Please consult the current XCPD supplement to ensure the latest version is being used.

3.55.5.1 Security Audit Considerations

The Cross Gateway Patient Discovery Transaction is a Query Information event as defined in Table ITI TF-2a: 3.20.6-1.

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[2] A more appropriate coding system will be used for this extension when it is available.

There are no specific auditing requirements for the Revoke Message.

The Actors involved shall record audit events according to the following:

3.55.5.1.1 Initiating Gateway audit message:

	Field Name	Opt	Value Constraints
Event **AuditMessage/ EventIdentification**	EventID	M	EV(110112, DCM, "Query")
	EventActionCode	M	"E" (Execute)
	EventDateTime	M	*not specialized*
	EventOutcomeIndicator	M	*not specialized*
	EventTypeCode	M	EV("ITI-55", "IHE Transactions", "Cross Gateway Patient Discovery")
Source (Initiating Gateway) (1)			
Human Requestor (0..n)			
Destination (Responding Gateway) (1)			
Audit Source (Initiating Gateway) (1)			
Patient (1)			
Query Parameters(1)			

Where

	Field Name	Opt	Value Constraints
Source **AuditMessage/ ActiveParticipant**	UserID	C	When WS-Addressing is used: value of <ReplyTo/> element
	AlternativeUserID	M	the process ID as used within the local operating system in the local system logs.
	UserName	U	*not specialized*
	UserIsRequestor	M	"true"
	RoleIDCode	M	EV(110153, DCM, "Source")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.
Human Requestor (if known) **AuditMessage/ ActiveParticipant**	UserID	M	Identity of the human that initiated the transaction.
	AlternativeUserID	U	*not specialized*
	UserName	U	*not specialized*
	UserIsRequestor	M	"true"
	RoleIDCode	U	Access Control role(s) the user holds that allows this transaction.
	NetworkAccessPointTypeCode	NA	
	NetworkAccessPointID	NA	

Destination AuditMessage/ ActiveParticipant	UserID	M	SOAP endpoint URI.
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.
Audit Source AuditMessage/ AuditSourceIdentification	*AuditSourceID*	*U*	*Not specialized.*
	AuditEnterpriseSiteID	*U*	*not specialized*
	AuditSourceTypeCode	*U*	*not specialized*
Patient (AudittMessage/ ParticipantObjectIdentification)	ParticipantObjectTypeCode	M	"1" (Person)
	ParticipantObjectTypeCodeRole	M	"1" (Patient)
	ParticipantObjectDataLifeCycle	U	not specialized
	ParticipantObjectIDTypeCode	M	EV(2, RFC-3881, "Patient Number")
	ParticipantObjectSensitivity	U	not specialized
	ParticipantObjectID	M	The local patient ID in HL7 CX format.
	ParticipantObjectName	U	not specialized
	ParticipantObjectQuery	U	not specialized
	ParticipantObjectDetail	U	not specialized
Query Parameters (AudittMessage/ ParticipantObjectIdentification)	ParticipantObjectTypeCode	M	"2" (system object)
	ParticipantObjectTypeCodeRole	M	"24" (query)
	ParticipantObjectDataLifeCycle	U	not specialized
	ParticipantObjectIDTypeCode	M	EV("ITI-55, "IHE Transactions", "Cross Gateway Patient Discovery")
	ParticipantObjectSensitivity	U	not specialized
	ParticipantObjectID	M	Stored Query ID (UUID)
	ParticipantObjectName	C	If known the value of <ihe:HomeCommunityId/>
	ParticipantObjectQuery	M	the QueryByParameter segment of the query, base64 encoded.
	ParticipantObjectDetail	U	not specialized

3.55.5.1.2 Responding Gateway audit message:

	Field Name	Opt	Value Constraints
Event **AuditMessage/** **EventIdentification**	EventID	M	EV(110112, DCM, "Query")
	EventActionCode	M	"E" (Execute)
	EventDateTime	*M*	*not specialized*
	EventOutcomeIndicator	*M*	*not specialized*
	EventTypeCode	M	EV("ITI-55", "IHE Transactions", "Cross Gateway Patient Discovery")
Source (Initiating Gateway) (1)			
Destination (Responding Gateway) (1)			
Audit Source (Responding Gateway) (1)			
Patient (0..n) *one for each*			

Where:

	Field Name	Opt	Value Constraints
Source **AuditMessage/** **ActiveParticipant**	UserID	C	When WS-Addressing is used: value of <ReplyTo/> element
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"true"
	RoleIDCode	M	EV(110153, DCM, "Source")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.
Destination **AuditMessage/** **ActiveParticipant**	UserID	M	SOAP endpoint URI.
	AlternativeUserID	M	the process ID as used within the local operating system in the local system logs.
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.
Audit Source **AuditMessage/** **AuditSourceIdentification**	*AuditSourceID*	*U*	*Not specialized.*
	AuditEnterpriseSiteID	*U*	*not specialized*
	AuditSourceTypeCode	*U*	*not specialized*
Patient **(AudittMessage/** **ParticipantObjectIdentification)**	ParticipantObjectTypeCode	M	"1" (Person)
	ParticipantObjectTypeCodeRole	M	"1" (Patient)

	ParticipantObjectDataLifeCycle	U	not specialized
	ParticipantObjectIDTypeCode	M	EV(2, RFC-3881, "Patient Number")
	ParticipantObjectSensitivity	U	not specialized
	ParticipantObjectID	M	The patient ID in HL7 CX format.
	ParticipantObjectName	U	not specialized
	ParticipantObjectQuery	U	not specialized
	ParticipantObjectDetail	U	not specialized
Query Parameters **(AudittMessage/ ParticipantObjectIdentification)**	ParticipantObjectTypeCode	M	"2" (system object)
	ParticipantObjectTypeCode Role	M	"24" (query)
	ParticipantObjectDataLifeCycle	U	not specialized
	ParticipantObjectIDTypeCode	M	EV("ITI-55", "IHE Transactions", "Cross Gateway Patient Discovery")
	ParticipantObjectSensitivity	U	not specialized
	ParticipantObjectID	M	Not specialized
	ParticipantObjectName	C	If known the value of <ihe:HomeCommunityId/>
	ParticipantObjectQuery	M	the QueryByParameter segment of the query, base64 encoded.
	ParticipantObjectDetail	U	not specialized

Appendix A: Sample Messages

Patient Discovery Request

```xml
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://www.w3.org/2003/05/soap-envelope"
                  xmlns:wsa="http://www.w3.org/2005/08/addressing">
  <soapenv:Header>
    <wsa:Action s:mustUnderstand="1">
               urn:hl7-org:v3:PRPA_IN201305UV02:CrossGatewayPatientDiscovery
    </wsa:Action>
    <wsa:MessageID>urn:uuid:a02ca8cd-86fa-4afc-a27c-16c183b2055</wsa:MessageID>
    <wsa:ReplyTo>
      <wsa:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </wsa:ReplyTo>
    <wsa:To s:mustUnderstand="1">http://localhost:2647/Service/IHERespondingGateway.svc</wsa:To>
    <wsa:From>http://http://generalhospital.org/nhiegateway/PatientDiscovery</wsa:From>

    <wsse:Security soapenv:mustUnderstand="true">
      <!— Includes necessary security header information as defined
          in the Messaging Platform Specification -->
    </wsse:Security>
  </soapenv:Header>
  <s:Body>
    <PRPA_IN201305UV02 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                       xsi:schemaLocation="urn:hl7-org:v3
                        ../../schema/HL7V3/NE2008/multicacheschemas/PRPA_IN201305UV02.xsd"
                       xmlns="urn:hl7-org:v3"
                       ITSVersion="XML_1.0">
      <id root="1.2.840.114350.1.13.0.1.7.1.1" extension="35423"/>
      <creationTime value="20090417150301"/>
      <interactionId root="2.16.840.1.113883.1.6" extension="PRPA_IN201305UV02"/>
      <processingCode code="T"/>
      <processingModeCode code="I"/>
      <acceptAckCode code="AL"/>
      <receiver typeCode="RCV">
        <device  classCode="DEV" determinerCode="INSTANCE">
          <id root="1.2.840.114350.1.13.999.234"/>
          <telecom value="http://servicelocation/QDQuery"/>
        </device>
      </receiver>
      <sender typeCode="SND">
          <device classCode="DEV" determinerCode="INSTANCE">
              <id root="1.2.840.114350.1.13.999.567"/>
              <!-- Used to carry the homeCommunityId -->
              <agent classCode="AGENT">
               <organization classCode="ORG" determinerCode="INSTANCE">
                  <!-- homeCommunityId=urn:oid:1.2.3 -->
                  <id root="1.2.3"/>
               </organization>
              </agent>
          </device>
      </sender>
      <controlActProcess  classCode="CACT" moodCode="EVN">
          <code code="PRPA_TE201305UV02" codeSystem="2.16.840.1.113883.1.6"/>

          <!-- Identifies one of LivingSubjectID for use by responder
            - provisioning the opposite direction -->
          <authorOrPerformer typeCode="AUTH">
            <assignedDevice>
              <id root="1.2.840.114350.1.13.99997.2.3412"/>
            </assignedDevice>
          </authorOrPerformer>

          <queryByParameter>
```

```
                <queryId root="1.2.840.114350.1.13.28.1.18.5.999" extension="18204"/>
                <statusCode code="new"/>
                <responsePriorityCode code="I"/>
                <parameterList>
                    <livingSubjectAdministrativeGender>
                        <value code="M"/>
                        <semanticsText>LivingSubject.administrativeGender</semanticsText>
                    </livingSubjectAdministrativeGender>
                    <livingSubjectBirthTime>
                        <value value="19630804"/>
                        <semanticsText>LivingSubject..birthTime</semanticsText>
                 </livingSubjectBirthTime>
                 <livingSubjectName>
                        <value>
                            <given>Jimmy</given>
                            <family>Jones</family>
                        </value>
                        <semanticsText>LivingSubject.name</semanticsText>
                    </livingSubjectName>
                    <LivingSubjectId>
                        <value root="1.2.840.114350.1.13.99997.2.3412" extension="1234"/>
                        <semanticsText>LivingSubject.id</semanticsText>
                    </LivingSubjectId>
                    <LivingSubjectId> <!-- Specifies a fictitious SSN of 999-99-9999 -->
                        <value root="2.16.840.1.113883.4.1" extension="999999999" />
                        <semanticsText>LivingSubject.id</semanticsText>
                    </LivingSubjectId>
                </parameterList>
            </queryByParameter>
        </controlActProcess>
    </PRPA_IN201305UV02>
</soapenv:Body>
</soapenv:Envelope>
```

Patient Discovery Response

```
<?xml version="1.0" encoding="UTF-8"?>
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
            xmlns:a="http://www.w3.org/2005/08/addressing">
 <s:Header>
   <a:Action s:mustUnderstand="1">
        urn:hl7-org:v3:PRPA_IN201306UV02:CrossGatewayPatientDiscovery
   </a:Action>
  <a:RelatesTo>urn:uuid:1ec52e14-4aad-4ba1-b7d3-fc9812a21340</a:RelatesTo>
</s:Header>
 <s:Body>
  <PRPA_IN201306UV02 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                     xsi:schemaLocation="urn:hl7-org:v3
            ../../schema/HL7V3/NE2008/multicacheschemas/PRPA_IN201306UV02.xsd"
                     xmlns="urn:hl7-org:v3" ITSVersion="XML_1.0">
   <id root="1.2.840.114350.1.13.999.238" extension="55789"/>
   <creationTime value="20090417150302"/>
   <interactionId root="2.16.840.1.113883.1.6" extension="PRPA_IN201306UV02"/>
   <processingCode code="T"/>
   <processingModeCode code="I"/>
   <acceptAckCode code="NE"/>
   <receiver typeCode="RCV">
       <device classCode="DEV" determinerCode="INSTANCE">
           <id root="1.2.840.114350.1.13.999.567"/>
       </device>
   </receiver>
   <sender typeCode="SND">
       <device classCode="DEV" determinerCode="INSTANCE">
           <id root="1.2.840.114350.1.13.999.234"/>
           <telecom value="http://servicelocation/QDQuery"/>
       </device>
   </sender>
   <acknowledgement>
```

```
        <typeCode code="AA"/>
        <targetMessage>
          <id root="1.2.840.114350.1.13.0.1.7.1.1" extension="35423"/>
        </targetMessage>
  </acknowledgement>
  <controlActProcess classCode="CACT" moodCode="EVN">
      <code code="PRPA_TE201306UV02" codeSystem="2.16.840.1.113883.1.6"/>
      <subject typeCode="SUBJ">
          <registrationEvent classCode="REG" moodCode="EVN">
              <id nullFlavor="NA"/>
              <statusCode code="active"/>
              <subject1 typeCode="SBJ">
                  <patient classCode="PAT">
                      <id root="1.2.840.114350.1.13.99998.8734" extension="34827K410"/>
                      <statusCode code="active"/>
                      <patientPerson>
                          <name>
                              <given>James</given>
                              <family>Jones</family>
                          </name>
                          <telecom value="tel:+1-481-555-7684;ext=2342" use="WP"/>
                          <telecom value="tel:+1-765-555-4352" use="HP"/>
                          <administrativeGenderCode code="M"/>
                          <birthTime value="19630804"/>
                          <addr>
                              <streetAddressLine>3443 North Arctic Avenue</streetAddressLine>
                              <city>Some City</city>
                              <state>IL</state>
                          </addr>
                          <asOtherIDs classCode="PAT">
                              <id root="1.2.840.114350.1.13.99997.2.3412"
                                      extension="38273D433"/>
                              <scopingOrganization classCode="ORG" determinerCode="INSTANCE">
                                  <id root="1.2.840.114350.1.13.99997.2.3412"/>
                              </scopingOrganization>
                          </asOtherIDs>
                          <asOtherIDs classCode="CIT">
                              <id root="2.16.840.1.113883.4.1" extension="999999999"/>
                              <scopingOrganization classCode="ORG" determinerCode="INSTANCE">
                                  <id root="2.16.840.1.113883.4.1"/>
                              </scopingOrganization>
                          </asOtherIDs>
                      </patientPerson>
                      <providerOrganization classCode="ORG" determinerCode="INSTANCE">
                          <id root="1.2.840.114350.1.13.99998.8734"/>
                          <name>Good Health Clinic</name>
                          <contactParty classCode="CON">
                              <telecom value="tel:+1-342-555-8394"/>
                          </contactParty>
                      </providerOrganization>
                  </patient>
              </subject1>
              <custodian typeCode="CST">
                  <assignedEntity classCode="ASSIGNED">
                      <!-- Required element containing the homeCommunityId for the community
                          responding to the request -->
                      <id root="1.2.840.114350.1.13.99998.8734"/>
                      <!-- Required element defining whether the responding community
                          supports the Patient Location Query transaction for this patient -->
                      <code code="NotHealthDataLocator"
                              codeSystem="1.3.6.1.4.1.19376.1.2.27.2"/>
                  </assignedEntity>
              </custodian>
          </registrationEvent>
      </subject>
      <subject typeCode="SUBJ">
          <registrationEvent classCode="REG" moodCode="EVN">
              <id nullFlavor="NA"/>
              <statusCode code="active"/>
              <subject1 typeCode="SBJ">
```

```
                <patient classCode="PAT">
                    <id root="1.2.840.114350.1.13.99998.4029401" extension="34827R534"/>
                    <statusCode code="active"/>
                    <patientPerson>
                        <name>
                            <given>Jim</given>
                            <family>Jones</family>
                        </name>
                        <telecom value="tel:+1-795-555-4745" use="HP"/>
                        <administrativeGenderCode code="M"/>
                        <birthTime value="19630713"/>
                        <addr>
                            <streetAddressLine>8734 Blue Ocean Street</streetAddressLine>
                            <city>Other City</city>
                            <state>IL</state>
                        </addr>
                        <asOtherIDs classCode="CIT">
                            <id root="2.16.840.1.113883.4.1" extension="999-89-3300"/>
                            <scopingOrganization classCode="ORG" determinerCode="INSTANCE">
                                <id root="2.16.840.1.113883.4.1"/>
                            </scopingOrganization>
                        </asOtherIDs>
                    </patientPerson>
                    <providerOrganization classCode="ORG" determinerCode="INSTANCE">
                        <id root="1.2.840.114350.1.13.99998.8734"/>
                        <name>Good Health Clinic</name>
                        <contactParty classCode="CON">
                            <telecom value="tel:+1-342-555-8394"/>
                        </contactParty>
                    </providerOrganization>
                </patient>
            </subject1>
            <custodian typeCode="CST">
                <assignedEntity classCode="ASSIGNED">
                    <!-- Required element containing the homeCommunityId for the community
                         responding to the request -->
                    <id root="1.2.840.114350.1.13.1.4"/>
                    <!-- Required element defining whether the responding community
                         supports the Patient Location Query transaction for this patient -->
                    <code code="NotHealthDataLocator"
                          codeSystem="1.3.6.1.4.1.19376.1.2.27.2"/>
                </assignedEntity>
            </custodian>
        </registrationEvent>
    </subject>
    <queryAck>
        <queryId root="1.2.840.114350.1.13.28.1.18.5.999" extension="18204"/>
        <queryResponseCode code="OK"/>
    </queryAck>
    <queryByParameter>
        <queryId root="1.2.840.114350.1.13.28.1.18.5.999" extension="18204"/>
        <statusCode code="new"/>
        <parameterList>
            <livingSubjectAdministrativeGender>
                <value code="M"/>
                <semanticsText>LivingSubject.administrativeGender</semanticsText>
            </livingSubjectAdministrativeGender>
            <livingSubjectBirthTime>
                <value value="19630804"/>
                <semanticsText>LivingSubject..birthTime</semanticsText>
            </livingSubjectBirthTime>
            <livingSubjectName>
                <value>
                    <given>Jimmy</given>
                    <family>Jones</family>
                </value>
                <semanticsText>LivingSubject.name</semanticsText>
            </livingSubjectName>
            <LivingSubjectId>
                <value root="1.2.840.114350.1.13.99997.2.3412" extension="1234"/>
```

```
                    <semanticsText>LivingSubject.id</semanticsText>
                </LivingSubjectId>
                <LivingSubjectId>
                    <value root="2.16.840.1.113883.4.1" extension="58910"/>
                    <semanticsText>LivingSubject.id</semanticsText>
                </LivingSubjectId>
            </parameterList>
        </queryByParameter>
    </controlActProcess>
 </PRPA_IN201306UV02>
 </s:Body>
</s:Envelope>
```

Appendix B: Probabilistic Matching Risks and Mitigation

In the absence of a National Patient Identifier, the NHIN relies on probabilistic matching to allow NHIOs to resolve the identity of mutual patients. There are few examples of mission critical, large scale, cross enterprise probabilistic matching from which to leverage a proven approach. Further, many of the steps taken to maximize intra-NHIO patient search efficiency may not be compatible with inter-HIO patient discovery efficiency. In this section, the NHIN acknowledges a number of risks and explains mitigations contained in this specification. The NHIN further acknowledges that NHIOs varying technical implementations may impact their ability to employ mitigation strategies.

False Negatives: Unattended Match and Unambiguous Results

The responding NHIO is required to return a single match (per matching authority, if there are multiple). Traditionally, MPIs are configured to present multiple candidate matches for evaluation by a human being in order to accommodate common errors and improve user experience. MPIs are also used for unattended matching (e.g. data loading). The success of unattended matching often hinges on the thorough analysis patient data in order to establish defined parameters under the control of a single entity in order to tune the matching algorithm.

The following factors will contribute to the occurrence of false negatives, defined as the failure to identify a mutual patient:

1) Insufficient Data – Name, Date of Birth, and Gender may not be sufficient to return a single match. The use of the Required if Available attributes and requests for additional attributes is intended to mitigate this risk.

2) Use of non-immutable attributes – Demographic attributes held by different NHIOs for the same patient may be out of sync (e.g. phone number and address changes). Demographic mismatches will impact the ability of an MPI to return a single match. The ability to use immutable attributes (e.g. Birth Place) is intended to mitigate this risk.

3) Attribute Variability – During typical MPI implementation and configuration, patient data is thoroughly analyzed in order to tune the matching algorithm according to a combination of parameters which may be unique to a given environment. The use of "Required if Available" attributes may introduce variability which will impact the matching efficiency. The set of "Required" and recommended set of "Required if Available" attributes listed in the specification provide a baseline for consistent attribute matching that is intended to mitigate this risk.

4) Independent Match Evaluation – The initiating NHIO presents its set of patient demographics to another NHIO. If the responding NHIO is able to identify a single match, it must respond with its own set of demographics for the candidate patient. The initiating NHIO can either accept the candidate match or use the responder's set of demographics to evaluate the match. If the latter, the risks of a false positive outlined in this section are doubled. The option to request additional attributes and the use of immutable attributes is intended to mitigate this risk.

Impact of False Negatives

The impact of a false negative ranges from the inconvenient, in which a clinician or consumer must manually intervene to exchange health information, to life threatening in which vital information needed to inform clinical decisions is delayed or unavailable. NHIN does not minimize the impact of false negatives and will work with NHIOs to devise strategies and solutions to minimize it.

False Positives: Mismatched Patient Identities

In the absence of a centralized Master Person Index and National Patient Identifier, NHIOs must maintain disparate mechanisms to associate records with patients and to establish patient identity during record retrieval.

The following factors will contribute to false positives, which is defined as the incorrect match of two different patients.

1) False Positive Matching – May occur when two HIOs evaluate patient demographics and return a single high scoring false match. Most likely to be associated with multiple births living at the same address. This unlikely but serious risk can be dramatically reduced if the initiating NHIO evaluates the demographics returned by the responder.

2) Merge/Unmerge – HIOs may internally encounter situations in which two patients have been given the same identifier. This occurrence is most often associated with multiple births or when an infant's records are associated with the mother's in the first days of life. This risk can be mitigated by validating retrieved information with the patient.

Impact of False Positives

The impact of a false positive is considered to be far more serious than a false negative. This specification is designed to minimize the likelihood and persistence of false positives through the following means:

- Ability for the initiating and responding NHIO to independently evaluate matching criteria.
- The intent for NHIOs to re-discover at each patient encounter in advance of query/retrieve transactions.